

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
RESEARCH AND TECHNOLOGY RESUME

## TITLE

Outer Planet Studies — NSG-7499

## PERFORMING ORGANIZATION

Lowell Observatory  
1400 West Mars Hill Road  
Flagstaff, Arizona 86001

## INVESTIGATOR'S NAME

Barry L. Lutz

*DESCRIPTION (a. Brief statement on strategy of investigation; b. Progress and accomplishments of prior year; c. What will be accomplished this year, as well as how and why; and d. Summary bibliography)*

The tasks of this grant include observational studies of the composition, structure and variability of planetary and satellite atmospheres, and the investigation of the problems associated with the fundamental calibration of these data. These studies are essential to providing "ground-truth" support for observations of the solar system by NASA's missions, including the *Voyager* and *Galileo* spacecraft, the *Hubble Space Telescope*, and the proposed *CRAF-Cassini* mission. Complementary spectroscopic observations of comets were added in BY88 to support NASA's cometary program goals of the *CRAF-Cassini* mission. A very modest laboratory effort is also maintained to provide essential data needed by these observational programs, which may be otherwise unavailable.

Main accomplishments during BY88 include: (1) Discovery of HDO in the spectrum of Mars and the first determination of the D/H ratio in its atmosphere; (2) Completion and publication of our study of CH<sub>3</sub>D in the spectrum of Titan and a determination of the mixing ratio in its atmosphere; (3) Completion of our observations of CH<sub>3</sub>D in the spectrum of Neptune and a preliminary analysis of the CH<sub>3</sub>D/CH<sub>4</sub> mixing ratio in its atmosphere.

Major efforts proposed for BY89 include: (1) Completion of our analysis of CH<sub>3</sub>D in the spectrum of Neptune and a determination of the CH<sub>3</sub>D/CH<sub>4</sub> ratio in its atmosphere, as part of our groundbased support of the *Voyager* mission encounter with Neptune in 1989; (2) Search for HDO in the atmosphere of Venus as part of our investigation of the distribution of deuterium in the solar system and its relationship to the origin and evolution of the planets; (3) Completion of time series of spectrophotometric observations of Neptune and a determination of its geometric and Bond albedos as part of our study of temporal variability of its atmosphere, in preparation for the 1989 *Voyager* encounter; (4) Publication of the recalibration of the Sun against Vega and continuation of our study of the fundamental calibration problems associated with solar analogs, needed to accurately determine planetary albedos on a common photometric scale; (5) Continuation of our times series of spatially resolved spectrophotometric observations of the Jovian belts and zones to characterize the spatial and temporal variations of the Jovian atmospheric structure in support of the *Galileo* mission.

**PAPERS PUBLISHED IN REFEREEED JOURNALS AND MEETING  
PROCEEDINGS IN BY 1987/1988**

"The Solar System/Interstellar Medium Connection: Gas Phase Abundances" (invited review, B. L. Lutz), in *Interstellar Processes* (D. J. Hollenbach and H. A. Thronson, Jr., eds.). D. Reidel Publishing Company, Dordrecht, 1987.

"Monodeuterated Methane in the Outer Solar System. II. Its Detection on Uranus at 1.6 Microns" (C. de Bergh, B. L. Lutz, T. Owen, J. Brault, and J. Chauville), *The Astrophysical Journal*, 15 June 1988.

"Deuterium on Mars: The Abundance of HDO and the Value of D/H" (T. Owen, J.-P. Maillard, C. de Bergh, and B. L. Lutz), *Science*, in press.

"Spatial and Temporal Variations in the Atmosphere of Jupiter: Polarimetric and Photometric Constraints" (B. E. Carlson and B. L. Lutz), in *Proceedings of the International Workshop on Time-Variable Phenomena in the Jovian System*, NASA Special Publication (M. J. Belton and R. A. West, eds.), in press.